F/A-18 E/F SUPER HORNET

Navy ACAT IC Program		**Prime Contractor**
Total Number of Systems:	12 LRIP-1 20 LRIP-2 548 Production	Boeing
Total Program Cost (TY$):	$47.0B	
Average Unit Cost (TY$):	$49.9M	
Full-rate production:	3QFY00	
SEP Production	3QFY94	

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The F/A-18E and F Super Hornet, single and dual seat respectively, is a multi-mission day/night strike fighter aircraft designed to overcome existing deficiencies in F/A-18 C/D range, specifically endurance, and carrier bring-back payload. The F/A-18E/F features a larger airframe with more fuel capacity and two additional store stations. It will also have a reduced radar signature, advanced engines, extensive use of composites, and improvements to some avionics and displays. The projected firepower from Super Hornets operating from aircraft carriers is a key contributor to the ***Joint Vision 2010*** concepts of ***dominant maneuver*** and ***precision engagement***.

BACKGROUND INFORMATION

In April 1992, the DAB approved a Milestone IV/II for the F/A-18 E/F program. The Navy entered the EMD phase, which concludes in FY00. During EMD, two EOAs (OT-I and OT-IA) and two periods of OT&E (OT-IIA and OT-IIB) were conducted. First flight of the F/A-18E/F occurred in November 1996. OT-I and IA were completed in February and December 1996, respectively. In both cases, COMOPTEVFOR concluded that the F/A-18E/F was potentially operationally effective and potentially operationally suitable.

A single DAB-level decision was reached in March 1997, with a decision to enter LRIP and delegation to the Navy of the Milestone III full-rate production decision. A total of seven aircraft are included in the EMD program. These aircraft have been undergoing testing by an integrated test team of contractor and Navy pilots since early 1997.

OT-IIA was completed in November 1997, with an assessment of potentially operational effective and potentially operationally suitable. Flight testing focused on validation of the performance data base to assess the accuracy of range and performance predictions. All key performance parameters were met.

OT-IIB, conducted in two phases, was completed in November 1998 with an assessment of potentially operational effective and potentially operationally suitable. An expanded envelope afforded the pilots the opportunity to evaluate the aircraft in a wide variety of tactical roles such as Weapons Delivery Accuracy, Dissimilar Air Combat Maneuvering, Night Vision Device Suitability, Fighter Escort, Interdiction, and Close Air Support.

Prior to full-rate production, three LRIP lots are planned. LRIP-1 (12 aircraft) and LRIP-2 (20 aircraft) are currently under contract. LRIP-1 includes the aircraft that have been tested during OPEVAL.

The F-18E/F Live Fire Test and Evaluation Program was granted a waiver to conduct less than full-up, system-level testing in May 1992. With the waiver approval, the program was required to execute an Alternative Plan, which included comprehensive ballistic testing of components and major assemblies. Building on the vulnerability reduction program for the early F/A-18 aircraft and joint live fire testing of the F/A-18C, as well as actual combat damage incidents, the Navy continues to pursue an aggressive LFT&E program for the F/A-18E/F. Testing is now ongoing on the nearly full-up drop test aircraft reconfigured for Live Fire testing. These tests include precedent setting ballistic shots with a running F-414 engine.

TEST & EVALUATION ACTIVITY

OT-IIC was conducted from May-November 1999. DOT&E approved all test plans and monitored the conduct of IOT&E in its entirety. During this operational evaluation, seven production aircraft were tested in a variety of rigorous and operationally realistic environments. Much of the testing took place at China Lake, CA, and included live fire weapons firing and flights in support of Air-to-Ground Weapons, Air-to-Air Sensors, Air Combat Maneuvering, Defense Suppression, and Survivability. Testing that focused on air combat took place at NAS Key West, FL, from June 14-25. An at sea phase took place from July 12-28 aboard USS JOHN C. STENNIS CVN 74. The aircraft was operated from an aircraft carrier and conducted simulated alert launches, long range strikes, and tanking among many other tasks. The aircraft also participated in a Combined/Joint Exercise Red Flag at Nellis

AFB, NV, from August 16–27. The final portion of testing was completed at China Lake, CA, and consisted of survivability assessments, live fire of air to air and precision air to ground ordnance and air to air gunnery. IOT&E results are currently being evaluated by COTF and DOT&E, and will be reported to Congress in support of the F/A-18E/F full production decision. This assessment is based on past testing and results from IOT&E.

Other testing pertaining to F/A-18E/F survivability (and being monitored by DOT&E) included the ALE-50 Towed Decoy and the ALR 67(V3).

The LFT&E Alternative Plan includes ballistic tests on the F/A-18E/F airframe originally manufactured for drop and barricade testing. Prior to the airframe being designated as an LFT article, it suffered damage during barricade testing. Subsequently, the airframe was shipped to Boeing facilities in St. Louis, MO, where repairs were completed. Following certification by the Navy, the airframe was designated as SV52, the LFT article. SV52 is the third production F/A-18E EMD aircraft. A fuel cell qualification test (non-ballistic) was conducted on the airframe during June 1998, validating design goals. Testing conducted during FY98 focused on system components and sub-assemblies. An extensive effort was also conducted on the F414 engine. Highly realistic and complex, these ballistic events against the SV52 included testing of the horizontal stabilator and the wing leading edge, fuel ingestion tests, and engine bay fire extinguishing system tests with a running F-414 engine.

TEST & EVALUATION ASSESSMENT

IOT&E Air-to-Ground Phase - The evaluation began on May 27 at China Lake, CA. Flights in support of Air-to-Ground Weapons, Air-to-Air Sensors, Air Combat Maneuvering, Defense Suppression, and Survivability were conducted. During this phase, several items of significance were accomplished:

- Air-to-Ground Weapons. There were multiple ordnance flights dropping a variety of weapons such as Mk 82 (500lb), Mk 83 (1000lb), and CBUs (cluster bombs).

- Tanking. For the first time since the A6 aircraft, a new organic “by design” tanking capability was demonstrated by the F/A-18E/F during day and night operations. The ability of a tactical aircraft to provide airborne refueling at profiles and speeds that match requirements of strike aircraft is a significant capability needed by the fleet.

- Maintenance. The maintenance personnel continued to learn how to use a new computerized portable maintenance system associated with this aircraft.

- Training. In support of the simulated air combat phase, each aircrew received instruction and flights focusing on high angle of attack maneuvering and general confidence building events. These included air-to-air weapons performance verification and several range profiles to verify the flight performance data base.

Air Combat Phase - This phase took place at NAS Key West, FL, from June 14-25. During this detachment, portions of Fighter Escort, Combat Air Patrol, Air Combat Maneuvering, Tactics, and Survivability were assessed.

- Scenarios generally included up to four Super Hornets versus an equal or larger number of opponents. Mixed formations of FA18C's and Super Hornets were also flown to compare the two aircraft in similar scenarios.

- The 185th Fighter Squadron Air National Guard from Sioux City, IA, provided adversary support flying F16Cs. These F16Cs emulated the latest generation MiG-29 threat aircraft and flew realistic threat tactics.

- Going into OPEVAL, the air combat phase was the area of greatest concern. As noted in last years Annual Report, the aircraft has a slow top speed that encourages standoff tactics supported by current sensors and weapons. Otherwise, the F/A-18E/F can be run down from behind if it gets in situations where its speed is a disadvantage. Roadmap systems for the Super Hornet such as the Active Electronically Scanned Array antenna, and joint systems such as the Joint Helmet Mounted Cueing System and the AIM 9X, an improved Sidewinder "dog fight" missile, should regain our advantage in these areas. In the air combat arena, the aircraft displayed similar characteristics as OT-IIB. Dominant factors included. nose pointing and departure resistance. The two addressed deficiencies identified in OT-IIB (nose high to nose low transition and unloading characteristics) have been corrected and are now a positive influence in the ACM arena. Also, the majority of the planned fighter escort missions and nearly all of the Combat Air Patrol missions were completed during this phase.

- The underwing environment of the aircraft remains hostile and damage continues to occur on weapons simulators and carriage rails. The F/A-18E/F Program Office has initiated a review of these issues with the prime contractor. If not fixed, the long-term impact could be increased maintenance as well as higher logistic support costs for both the aircraft and the weapons that it carries. Bolts, screws, and lugs have been strengthened on underwing stores, and efforts are still underway to improve transonic performance. Data analysis is ongoing.

Carrier Operations - The Super Hornet operated from the deck of the USS JOHN C. STENNIS, CVN 74, near the southern California coast from July 12-28. The aircraft was integrated into Carrier Air Wing NINE and conducted simulated alert launches, long-range strikes and tanking among many other tasks. The aircraft performed very well in its intended environment.

- Integration with the air wing was described as "seamless," and the F/A-18E/F operated smoothly within the rest of the air wing. This is remarkable for a brand new aircraft. The aircraft demonstrated a high degree of flexibility in performing various air wing missions in a carrier environment. The Super Hornet's seemingly effortless ability to land on the carrier received very favorable remarks from ship and air wing personnel watching the tests.

- The additional fuel the aircraft carries is also a substantial benefit. In one instance, the normal recovery was delayed by an airborne emergency when an unrelated aircraft had to land with only one engine. This delayed other aircraft waiting to land. One Super Hornet, configured as a tanker, gave gas to two other Super Hornets allowing all three to wait out the delay and land. During another mission, a Super Hornet again configured as a tanker for a long-range strike, passed fuel to other aircraft, performed a secondary defense suppression mission, then reverted to the fighter role and simulated shooting down an adversary aircraft, then returned and recovered aboard the carrier.

- The airplane also bears a close resemblance to its predecessor and is almost identical at a distance. This can be a safety issue when landing on the aircraft carrier because the ships arresting gear has unique settings for each type aircraft. The program and Navy identified this as an issue some time ago and have tried various solutions to make the aircraft more obvious in the landing pattern both day and night. For the day pattern, a white strobe light has been fixed to the nose landing gear. This is unique to the Super Hornet and difference was obvious from the landing signal officer platform and the control tower. At night, the acquisition lights blink at a different rate than other aircraft in the air wing. This feature also aids aircraft to identify and join with the Super Hornets at night.

- During carrier tests, several minor problems were discovered, specifically excessive nose tire wear and some minor software weapons display issues. All are being addressed through the normal reporting process and should not pose a significant concern.

Combined/Joint Operations - The Super Hornet operated from Nellis AFB, NV, participating in a Combined/Joint Exercise Red Flag from August 16-27. Red Flag is an intense training exercise involving Air Force, Navy, Marine Corps and multinational assets in a realistic air campaign to attack representative threat targets with inert and live munitions. These assets are opposed by adversary aircraft and multiple surface to air threat systems. The exercise is conducted on an instrumented range and all parameters are recorded and played back for after action review.

The airplane performed well in a rigorous environment and continued to demonstrate flexibility in performing a variety of missions. Its ability to rapidly reconfigure for different missions, and assume multiple roles during a single mission, received favorable remarks from personnel participating in the exercise.

The benefit of additional weapons stations was particularly noteworthy. While configured as a bomber, the extra stations allowed the aircraft to protect itself with either more air-to-air weapons, more air-to-surface anti radiation missiles, or both. In many of the scenarios, the Super Hornet's predecessor would not have been able to accomplish the mission against the threat presented. The additional fuel the aircraft carried allowed the aircraft to fly profiles and routes that lessened their exposure to a variety of threats to and from the target.

Prior to OPEVAL, this aircraft was rated deficient in one of the Key Performance Parameters; an F/A-18F strike profile of 390 miles that was calculated to be missed by 2 miles. These performance parameters are computed using a flight performance database and had not actually been flown before. Immediately prior to Red Flag, a two-seat Super Hornet flew this profile and met the 390-mile requirement. The load carried was slightly heavier than required for the nominal strike profile and with a higher drag coefficient. This suggests that the computational models may be somewhat conservative.

Wrap Up - The main focus since returning from Nellis was air-to-air and smart weapon expenditure and survivability flights. Air-to-air gunnery and air-to-ground sensor flights rounded out the effort.

Early engine blade containment tests (tests to see how well the engine compressor can retain a thrown blade) showed signs of engine vulnerability. The engine casing was redesigned and subsequent tests indicate separated blades are contained. Fuel ingestion and ballistic tolerance tests conducted on the F-414 engine showed encouraging results in comparison to similar tests of the F-404. Extensive testing on the SV-52 aircraft including hydraulic ram and fuel ingestion tests with a running engine have been

very successful with no serious or unexpected vulnerabilities discovered. Testing has just been completed for the fuselage dry bay. The results are being evaluated at this time.

CONCLUSIONS, RECOMMENDATIONS, LESSONS LEARNED

The OT&E and LFT&E programs underway and planned for the remainder of the EMD phase are judged adequate to resolve all critical operational issues by Milestone III in 2000. DOT&E is closely involved in ongoing DT and OT, is monitoring the program's LFT&E activities, and will provide an independent assessment of the final results via a B-LRIP report at Milestone III. In that report, DOT&E plans to assess the survivability of the F/A-18E/F in the "as tested" OPEVAL-configuration and the intended fleet configuration, incorporating the Integrated Defensive Electronic Counter Measures suite under development as a separate EMD program.